

## **GOLF CLUB HEAD WITH MULTIPLE UNDERCUTS**

### **BACKGROUND OF THE INVENTION**

#### **1. Field of the Invention**

The present invention relates to a golf club head, and, more particularly, to a golf club  
5 head having multiple undercuts.

#### **2. Description of the Related Art**

Iron-type golf clubs generally include a front or striking face, a top line, and a sole.  
The front face interfaces with and strikes the golf ball. A plurality of score lines or grooves is  
positioned on the face to assist in imparting spin to the ball. The top line is generally  
10 configured to have a particular look to the golfer and to provide weight. The sole of the golf  
club is particularly important to the golf shot because it contacts and interacts with the ground  
during the golf shot.

In conventional sets of iron-type golf clubs, each club includes a shaft with a club head  
attached to one end and a grip attached to the other end. The club head includes a face for  
15 striking a golf ball. The angle between the face and a vertical plane is called the loft angle.

The set generally includes irons that are designated number 2 through number 9, and a  
pitching wedge. Other wedges, such as a lob wedge, a gap wedge, and a sand wedge, may be  
optionally included with the set. Each iron has a shaft length that usually decreases through  
the set as the loft for each club head increases from the long irons to the short irons. The  
20 length of the club, along with the club head loft and center of gravity location, impart various  
performance characteristics to the ball's launch conditions upon impact and determine the

distance the ball will travel. Flight distance generally increases with a decrease in loft angle. However, difficulty of use also increases with a decrease in loft angle.

Iron-type golf clubs generally can be divided into three categories: blades, muscle backs, and cavity backs. Blades are traditional clubs with a substantially uniform appearance 5 from the sole to the top line, although there may be some tapering from sole to top line.

Muscle backs have a substantially traditional appearance and are similar to blades, but have extra material on the back. This extra material, which may be in the form of a rib, can be used to lower the club head center of gravity. Having the club head center of gravity lower than the ball center of gravity at contact increases the launch angle of the resulting golf shot.

10 Since blade and muscle back designs have a small sweet spot (that is, the area of the face that results in a desirable golf shot upon striking a golf ball), they are relatively difficult to use and are therefore typically only used by skilled golfers. However, since these designs are less forgiving than cavity backs, they allow a skilled golfer to work the ball and shape the golf shot as desired.

15 Cavity backs are modern designs that move some of the club mass to the perimeter of the club by providing a hollow or cavity in the back of the club, opposite the striking face. This produces a more forgiving club with a larger sweet spot. This also allows the size of the club face to be increased, also resulting in a larger sweet spot. The perimeter weighting created by the cavity also increases the club's moment of inertia, which is a measurement of 20 the club's resistance to torque, for example the torque resulting from an off-center hit. Because of the increased moment of inertia, these clubs are easier to hit than blades and muscle backs, and are therefore usable by less-skilled and beginner golfers.

Other known golf clubs achieve a desired balance or moment of inertia by adding a weight to the club. These clubs typically add a weight member to the bottom surface of the sole, in the center thereof.

#### SUMMARY OF THE INVENTION

5 The present invention relates to a golf club head having multiple undercuts. The club head includes a body defining a striking face, a top line, a sole, and a back, and having a heel and a toe. The back contains a cavity. A plurality of recesses is provided within the cavity, with the recesses extending away from the cavity. The golf club head preferably is an iron-type golf club head.

10 The recesses may be oriented in a variety of ways. In a first arrangement, the recesses are aligned longitudinally to the striking face in a heel-to-toe direction. That is, a line can be drawn in the heel-to-toe direction that intersects each of the recesses. In a second arrangement, the recesses are aligned transverse to the striking face in a front-to-back direction and extend in a heel-to-toe direction. That is, a line can be drawn in the front-to-back direction that intersects each of the recesses. In a third arrangement, the plurality of recesses includes both longitudinally arranged and transversely arranged recesses.

15

The longitudinally arranged recesses preferably include a first recess positioned in a heel portion of the cavity and a second recess positioned in a toe portion of the cavity. A third recess may be provided intermediate the first and second recesses. The first and second recesses each have a volume from approximately 1 cubic centimeter to approximately 10 cubic centimeters, and have a depth of approximately 0.300 inch to approximately 0.800 inch. The third recess has a volume greater than each of the first and second recesses. Alternatively,

the third recess volume is greater than the combined volumes of the first and second recesses, and optionally it is greater than twice the combined volumes of the first and second recesses.

The third recess has a depth of approximately 0.450 inch to approximately 0.700 inch.

The transversely arranged recesses preferably include a first recess positioned adjacent

5 the back and a second recess positioned adjacent the first recess.

An insert is preferably positioned within each of the recesses. Preferred inserts include

weight members and dampening members. The types of inserts positioned within any specific

recess are varied, resulting in numerous permutations of club head designs. The specific

design chosen depends upon the golfer's swing and the desired characteristics of the club. For

10 the longitudinally arranged recesses, the weight inserts preferably have a mass greater than or

equal to approximately 10 grams. For the transversely arranged recesses, the weight inserts

have a mass of approximately 10 to approximately 20 grams. The weight members may also

have a mass less than 10 grams. For example, if a third weight member is included, it is

contemplated that it will have a mass less than 10 grams. In relative terms, the weight

15 members have a specific gravity greater than a specific gravity of the club head. If more than

one weight member is included, the weight members may or may not be substantially

identical. The dampening members preferably have a mass less than 10 grams and a specific

gravity less than the club head specific gravity. The recesses may also include a plurality of

inserts. For example, any specific recess may include both a weight member and a dampening

20 member positioned therein.

## DESCRIPTION OF THE DRAWINGS

The present invention is described with reference to the accompanying drawings, in which like reference characters reference like elements, and wherein:

5       Figure 1 shows a rear view of a first golf club head of the present invention;

Figure 2 shows another view of the golf club head of Figure 1;

Figure 3 shows a rear view of a second golf club head of the present invention;

Figure 4 shows a rear view of a third golf club head of the present invention; and

Figure 5 shows a rear view of a fourth golf club head of the present invention.

## DETAILED DESCRIPTION OF THE INVENTION

10       Figure 1 shows a rear view of a first golf club head 1 of the present invention. The club head 1 includes a body 10 defining a striking face 11, a top line 12, a sole 13, and a back 14. The club head 1 also has a heel 15 and a toe 16. The back 14 includes a cavity 20, and the cavity 20 contains multiple undercuts in the form of a plurality of recesses 22 extending away from the cavity 20. Preferably, the club head 1 is an iron-type golf club head.

15       The recesses 22 are provided in the club body 10 and extend toward the sole 13. This advantageously allows materials to be added to the club head 1 without penetrating the sole 13. In known club heads that include, for example, weight inserts, the weights are typically added through the sole. However, since weights are often softer than the club head body, and since the sole of the club strikes the ground during normal use of the golf club, the weights 20 will likely become dinged or worn, resulting in an unsightly appearance. The recesses 22 of the present invention, however, allow the addition of weights or other members to the club

head while isolating them from the sole 13. This prevents them from contacting the ground during the golf swing, and helps preserve the like-new appearance of the club.

By providing a plurality of recesses 22, the present invention allows a plurality of inserts to be added to the golf club independently. Each of the recesses 22 can accept an insert 5 independently of the other recesses 22. Identical inserts can be placed within each of the recesses 22, or each of the recesses 22 can house a unique member. In this manner, the golf club can be tailored to a golfer's unique swing characteristics. Preferably, the inserts completely fill the recesses 22.

Figure 2 shows another view of the golf club head 1 of Figure 1. In the illustrated 10 embodiment, the recesses 22 are aligned substantially longitudinally to the striking face 11 in a heel-to-toe direction. The golf club head 1 includes a first recess 25 positioned in a heel portion of the cavity 20 and a second recess 26 positioned in a toe portion of the cavity 20. Each of the recesses 25, 26 preferably has a volume from approximately 1 cubic centimeter to 15 approximately 10 cubic centimeters. Each of the recesses 25, 26 preferably has a depth of approximately 0.300 inch to approximately 0.800 inch, and more preferably approximately 0.450 inch to approximately 0.700 inch. These dimensions allow an insert, such as a weight member, of appropriate size and mass to be added to each of the recesses 25, 26. Note that due to the contours of the club head 1, the depths of the recesses will vary depending on the location at which the measurement is taken.

20 Figure 2 shows a first insert 35 positioned within the first recess 25 and a second insert 36 positioned within the second recess 26. The inserts 35, 36 may be weight members. Each of the recesses 25, 26 may include a weight member 35, 36, or only one of the recesses 25, 26

may include a weight member 35, 36. Alternatively, neither the recesses 25, 26 includes a weight member 35, 36. If weight members 35, 36 are present, each such weight member 35, 36 preferably has a mass from approximately 5g to approximately 30g, and more preferably greater than or equal to approximately 10 grams. The weight members 35, 36 may also be 5 described in terms relative the club head 1. Each weight member 35, 36 preferably may have a specific gravity greater than a specific gravity of the club head. The weight members 35, 36 may be substantially identical, or they may be different. The first weight member 35 may have a specific gravity that is less than the specific gravity of the second weight member 36. This may be desired for a golfer that tends to slice the ball, since biasing the club head center 10 of gravity toward the heel 15 makes it easier to close, decreasing the likelihood of leaving the club head open at impact. Alternatively, the first weight member 35 may have a specific gravity that is greater than the specific gravity of the second weight member 36. This may be desired for a golfer that tends to hook the ball, since biasing the club head center of gravity toward the toe 16 makes it harder to close, decreasing the likelihood of closing the club head 15 too soon or too much at impact. Preferably, weight members are included in each of the recesses 25, 26, moving more of the club head mass to the perimeter, producing a greater moment of inertia (MOI) and increasing the size of the club head sweet spot. Inertia is a property of matter by which a body remains at rest or in uniform motion unless acted upon by some external force. MOI is a measure of the resistance of a body to angular acceleration 20 about a given axis, and is equal to the sum of the products of each element of mass in the body and the square of the element's distance from the axis. Thus, as the distance from the axis

increases, the MOI increases, increasing the club head resistance to twisting due to off-center hits, making the club more forgiving.

In lieu of weight members, one or both of the inserts 35, 36 may be dampeners.

Preferred dampening materials, which diminish vibrations in the club head, including 5 vibrations generated during an off-center hit, include one or more of rubber, urethane, polyurethane, butadiene, polybutadiene, and silicone. The insert may completely fill the recess, or may fill only a portion thereof.

The illustrated embodiment of golf club head 1 further includes a third recess 27 intermediate the first and second recesses 25, 26. The third recess 27 allows a third insert to 10 be added to the club head 1 independently of the previously discussed inserts. The third recess 27 preferably has a volume greater than each of the first and second recesses 25, 26. The volume of the third recess 27 preferably may be greater than the combined volumes of the first and second recesses 25, 26, or it preferably may be greater than twice the combined 15 volumes of the first and second recesses 25, 26. The third recess 27 preferably has a depth of approximately 0.450 inch to approximately 0.700 inch, and more preferably approximately 0.250 inch to approximately 0.500 inch. These dimensions allow a member of appropriate size and mass to be added to the center of the club head 1.

A third insert 37 may be positioned within the third recess 27. The third insert 37 may be a weight member. If a weight member, it preferably has a mass less than approximately 10 20 grams. In relative terms, the third weight member 37 preferably has a specific gravity less than the club head specific gravity. The specific gravity of the third weight member 37 may be less than each of the specific gravities of the first and second weight members 35, 36.

Alternatively, the specific gravity of the third weight member 37 may be greater than each of the specific gravities of the first and second weight members 35, 36. Alternatively, the specific gravity of the third weight member 37 may be intermediate the specific gravities of the first and second weight members 35, 36.

5 Instead of being a weight member, the insert 37 may be something else, such as a dampening member. Use of a dampening member is useful to diminish vibrations in the club head 1, such as those generated during an off-center hit. A dampening member 37 may be used alone or in conjunction with other inserts 35, 36, such as weight members. The dampening member 37 preferably has a mass less than the masses of each of the weight 10 members 35, 36. In relative terms, the dampening member 37 has a specific gravity less than the specific gravity of the club head 1.

Figure 3 shows a rear view of a second golf club head 2 of the present invention. Like the first club head 1, the second club head 2 includes a plurality of recesses. The illustrated embodiment contains a toe recess 26, a central recess 27, and a heel recess 25 similar to the 15 first club head 1. The shapes and volumes of the recesses, however, are different than in the first club head 1.

Figure 4 shows a rear view of a third golf club head 3 of the present invention. Similarly to the previously discussed club heads , this club head 3 includes a body defining a striking face, a top line, a sole, a back, a heel, and a toe. The back includes a cavity, and the 20 cavity contains multiple undercuts in the form of a plurality of recesses extending away from the cavity. The recesses are provided in the club body and extend toward the sole.

The recesses of the third club head 3 are aligned substantially transverse to the striking face in a front-to-back direction and extend in a heel-to-toe direction. The plurality of recesses includes a first recess 42 positioned adjacent the back. Preferably, the first recess 42 has a volume of approximately 1 cubic centimeter to approximately 10 cubic centimeters. A 5 second recess 44 may also be provided in the back of the club head adjacent the first recess 42. The second recess 44 also preferably has a volume of approximately 1 cubic centimeter to approximately 10 cubic centimeters. Due to the contours of the club head 3, it is likely that the volume of the second recess 44 is less than the volume of the first recess 42.

Inserts may be provided within either or both of the recesses 42, 44. Contemplated 10 inserts include weights and vibration dampeners. For example, a weight member may be positioned within the first recess 42, and a dampening member may be positioned within the second recess 44. Alternatively, a dampening member may be positioned within the first recess 42, and a weight member may be positioned within the second recess 44, which will move the center of gravity toward the rear of the club head 3, increasing the MOI and making 15 the club more forgiving. Alternatively, both recesses 42, 44 may contain the same type of insert. The positioning of the weight and/or dampening members within the recesses 42, 44 and the masses of such members will affect the feel and playability of the golf club. Any weight members preferably have a specific gravity greater than a specific gravity of the club head, and any dampening members preferably have a specific gravity less than the club head 20 specific gravity. It is contemplated that the weight member has a mass of approximately 10 to approximately 20 grams.

Figure 5 shows a rear view of a fourth golf club head 4 of the present invention. The club head 4 includes a body defining a striking face, a top line, a sole, a back, a heel, and a toe. The back includes a cavity, and the cavity contains multiple undercuts in the form of a plurality of recesses extending away from the cavity. The recesses are provided in the club 5 body and extend toward the sole.

The recesses of the club head 4 include both types of recesses discussed above. A first recess 52 is aligned substantially transverse to the striking face, and extends in a heel-to-toe direction. A second recess 53 is aligned substantially longitudinally to the striking face, and is positioned in a heel portion of the cavity. A third recess 54 is aligned substantially 10 longitudinally to the striking face, and is positioned in a toe portion of the cavity. The second and third recesses 53, 54 are aligned in a heel-to-toe direction. A fourth recess 55 may be provided intermediate the second and third recesses 53, 54. Any desired combination of weight members and dampening members may be provided with the recesses 52, 53, 54, 55. In a preferred embodiment, a dampening member is provided within the first recess 52, and 15 weight members are provided within the second and third recesses 52, 54. Either a weight member or a dampening member may be provided within the fourth recess 55.

In each of the above-described golf club heads, the recesses can contain a plurality of inserts or a hybrid insert. For example, a weight member can be inserted into the lower part of any of the recesses, and a dampening member can be inserted atop the weight member. This 20 may advantageously allow for enhancement of MOI and sweet spot size, while simultaneously providing for vibration dampening.

While the preferred embodiments of the present invention have been described above, it should be understood that they have been presented by way of example only, and not of limitation. It will be apparent to persons skilled in the relevant art that various changes in form and detail can be made therein without departing from the spirit and scope of the invention. Thus the present invention should not be limited by the above-described exemplary embodiments, but should be defined only in accordance with the following claims and their equivalents.

5